Math 105 Midterm 1 Formula Sheet

- **Trigonometric Formulas:**

$$\sin^2(x) + \cos^2(x) = 1 \qquad\qquad \tan^2(x) + 1 = \sec^2(x)$$

$$\sin(2x) = 2\sin(x)\cos(x) \qquad\qquad \cos(2x) = \cos^2(x) - \sin^2(x)$$

$$\sin^2(x) = \frac{1}{2} - \frac{1}{2}\cos(2x) \qquad\qquad \cos^2(x) = \frac{1}{2} + \frac{1}{2}\cos(2x)$$

$$\sin(x+y) = \sin(x)\cos(y) + \sin(y)\cos(x) \qquad \cos(x+y) = \cos(x)\cos(y) - \sin(x)\sin(y)$$

- **Values of Trigonometric Functions:**

x	0	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$
$\sin(x)$	0	$\frac{\sqrt{1}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	1
$\cos(x)$	1	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{1}}{2}$	0

- **Derivatives of Inverse Trigonometric Functions:**

Notation: $\quad \sin^{-1}(x) = \arcsin(x) \qquad \tan^{-1}(x) = \arctan(x) \qquad \sec^{-1}(x) = \operatorname{arcsec}(x)$

$$\frac{d}{dx}\sin^{-1}x = \frac{1}{\sqrt{1-x^2}} \qquad \frac{d}{dx}\tan^{-1}x = \frac{1}{x^2+1} \qquad \frac{d}{dx}\sec^{-1}x = \frac{1}{|x|\sqrt{x^2-1}}$$

- **Numerical Integration:**

Midpoint Rule for $\int_a^b f(x)dx$, with $\Delta x = \frac{b-a}{n}$, $x_k = a + k\Delta x$:

$$M(n) = \sum_{k=1}^{n} f\left(\frac{x_{k-1} + x_k}{2}\right)\Delta x.$$

Trapezoid Rule for $\int_a^b f(x)dx$, with $\Delta x = \frac{b-a}{n}$, $x_k = a + k\Delta x$:

$$T(n) = \left(\frac{1}{2}f(x_0) + \sum_{k=1}^{n-1} f(x_k) + \frac{1}{2}f(x_n)\right)\Delta x.$$